

## Biotic composition in relation to occurrence of Zooplankton , Benthic fauna, Fishes and Aquatic fungi in the water bodies of Chikmagalur District of Karnataka: An overview

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### Abstract

The present review study deals with the occurrence and distribution of zooplankton, benthic fauna, fishes and aquatic Fungi in the lentic and lotic water bodies of Chikmagalur district of Karnataka as worked out by the various researchers. In the lentic habitat zooplankton were represented by Rotifera (06 species), Cladocera (06 species), Copepoda (04 species) and Protozoa with 02 species respectively. While, in the lotic sector Protozoans and Rotifers were consists of 15 species each, Crustaceans by 10 species and 04 species of insects were documented. In this study, 24 species of fishes and 26 species of aquatic fungi were recognized.

**Key words :** Biotic fauna, Zooplankton, Fishes, Insects, Aquatic fungi.

Zooplankton are susceptible to changes within the aquatic environment and any variation in their composition is usually a reaction of serious alteration in ambient conditions within aquatic ecosystem. Their abundance can also be regulated by abiotic and biotic factors<sup>14,21</sup>. Studies on Zooplankton are important in any water body to assess its biological status.

Among Zooplankton Cladocerans viz.,

*Daphnia* and *Moina* species constitute fish food in aquatic food chain. But, occurrence of *Mesocyclops* in the tanks may be possible due to the input of allochthonous litter from marginal vegetation on the banks of the waterbodies or land run-off into these aquatic systems.

Globally, around 45,000 species of insects live in fresh water ecosystem<sup>4</sup>. Aquatic insect are involved in nutrient recycling and

form an important element of natural food web. Some of them play a role in biological control of mosquitoes and many aquatic insects are used as a food for fishes and acts as pollution indicators. They are the most important bio-indicator of freshwater habitats such as lentic and lotic water bodies due to their different environmental disturbance tolerance levels<sup>2,15</sup>.

Fishes are not just significant pointers of environmental wellbeing and the wealth, yet additionally keep up a parity in the natural way of life by expending microscopic fish and little creatures and structure nourishment for some creatures. This balance in natural way of life might be influenced because of contamination in aquatic system. Furthermore, there are numerous dangers to fish variety, for example, development of dam, which hinder the producing relocations and presentation of fascinating species and over fishing. In this way, knowing the status of fish fauna is vital to prevent the loss of specific species<sup>20</sup>.

Fish can be utilized for natural evaluations at all degrees of natural association; appraisal systems are accessible at the degrees of biological system, populaces, people, organs and at the cell and molecular levels<sup>10</sup>. Other than to these credits, fishes are considered as one of the significant protein rich nourishment source among the water fauna<sup>1,26,29,30</sup>.

#### *Study area :*

Chikmagalur is the headquarters and is located about 251 kilometers from the state capital Bangalore and is surrounded by the Chandra Drona Hills and dense forests. The

district lies between 12° 54' 42" and 13° 53' 53" North latitude and between 75° 04' 46" and 76° 21' 50" East longitude. Coffee was grown in Chikmagalur. The Chikmagalur mountains, which are part of the Western Ghats, are the source of rivers such as Tunga and Bhadra. It is located in Mullayagiri district in Karnataka and is the highest peak. Tourist places like Kemmannugundi, Kudremukh, Manikadhar, Hebbe and Kallathigiri falls in Chikmagalur district have a rich history. The Hoysala temple in Amritapur. Kudremukh National Park and Bhadra Wildlife Sanctuary are located in this district. The map of Chikmagalur district is shown in Figure 1.

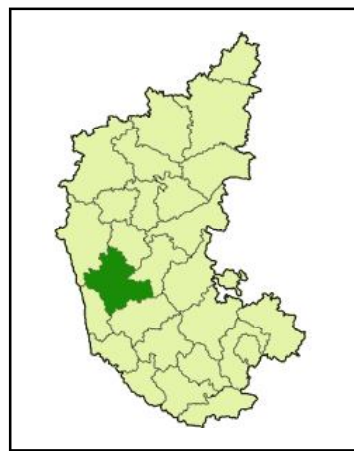


Figure 1. Study area map

Secondary data was collected by referring books, journals, monographs and web references. In addition, secondary information was gathered from local people of surrounding areas about the different fishes, insects by interviewing and showing pictures of the species to them.

The rotifer population was highest during summer season and lowest in Monsoon

season. Population of Cladocerans were found to be maximum during summer season and minimum during monsoon season in the water bodies. Copepod population was highest during summer season and their population was lowest during monsoon season.

However, protozoans were found to be maximum in summer season and minimum during monsoon season. In the present study, Rotifera was found as the most dominating group in all the waterbodies and represented by species like *Brachionus*, *Filinia*, *Keratella* and *Lepadella*. Rotiferas are chiefly freshwater forms and presence of these organisms in abundance is related to suitable condition for their survival<sup>7</sup>. Kaushik and Saxena<sup>11</sup> have also reported abundance of genus *Brachionus* in various waterbodies of central India. The genus *Brachionus* is of Gondwanian origin and invaded Euresia and North America by dispersal from Africa and India<sup>8</sup>. It is lacking in the cold regions. An abundance of *Brachionus* species it has been recorded from the tropical region and several species of this genus dominate the plankton community in the warmer part of peninsular India<sup>10,22</sup>. *Keratella* was also abundantly observed and Occurrence of this genus along with *Brachionus* indicate nutrient rich status of the waterbody<sup>6</sup>. Occurrence of *Paramecium* species and *Vorticella* species indicated that the water bodies are eutrophicated.

Rotifer richness and diversity were found to be maximum in summer indicating the influence of temperature which was supported by direct relation between summer temperature and rotifer population. Kaushik and Sharma<sup>13</sup> and Singh<sup>23</sup> who have studied

zooplankton population in Matsya Sarovar Gwalior and in tropical lake respectively.

The protozoans was represented by *Paramecium* and *Vorticella*. Protozoan population was recorded peak in summer season and their count remains low during monsoon months. Dilution of water caused by monsoon rain may explain low protozoan count observed during monsoon while maximum in summer months indicated a positive relationship with temperature, HCO<sub>3</sub>, Cl, Ca, Mg, etc. Similar type of observation were recorded by Paliwal<sup>16</sup> in Kali Nadi.

Cladoceran species observed were *Daphnia*, *Diaphanosoma*, *Moina daphnia*, *Macrothrix* and *Bosmina* species. Cladocerans were found to be maximum in summer season followed by winter season. The high populace of Cladocerans in summer and winter might be ascribed to favourable temperature and accessibility of nourishment as microbes, nanoplankton and suspended garbage while in monsoon the elements like water, temperature, DO, turbidity and transparency assume a significant job in controlling the assorted variety and density of Cladocera<sup>3,9</sup>.

In this review, *Cyclops*, *Mesocyclops*, *Paracyclops* and *Heliodiaptomus* were recorded. While, *Cyclops* were found to be common in all the waterbodies. Pawar and Pulle<sup>10</sup> also observed the presence of *Cyclops* and *Diaptomus* in Pethwadaj dam. These tanks rich in organic matter support higher number of Cyclopids, thus suggesting their preponderance in higher tropic state of water<sup>25</sup>. Similar observation was also made by Somani and Pejaver<sup>24</sup> in Masunda lake.

Rotifer fauna of tanks appeared rich and diverse dominating the tank throughout the study period. Rotifers have a remarkable quality that they are able to survive for long periods in dried or frozen condition and will resume normal behaviour when rehydrated or thawed. Zooplankton fauna of Chikmagalur water bodies was much more diversified and dominating. Most of the water bodies are highly nutrient rich and appears to undergo the state of eutrophication, if not managed properly.

Mrutyunjaya *et al.*,<sup>16</sup> have studied the water quality status of Ayyanakere lake near Chikmagalur district of Karnataka was assessed by zooplankton analysis. A total of 17 species and 15 genera of zooplankton were recorded. Among zooplankton cladocera was dominant group among zooplankton community constituting 33.33% of the zooplankton population.

#### *Biological parameters :*

Any kind of research with biological characteristics pertaining to riverine system will not be more successful unless does the other parameters apart from phytoplankton and physico-chemical characteristics. Though, it was not a major objectives of the present study, the authors felt that it is necessary to enlighten on the other features of biological complexes of the lotic water body. Therefore, the following aspects of river system were studied. They include:

1. Zoo plankton
2. Benthic fauna
3. Fishes
4. Aquatic fungi
5. Macrophytes and Periphytes

#### *Zooplankton :*

Studies on zooplankton are important in any water body to assess its biological status. Water was collected from the four sampling stations across the river stretch. The most common zooplankton under different groups recorded are Protozoa, Rotifera, Crustacea and Insecta. The important pollution indicators like Chironomous and Mosquito larvae were recorded in this category of zooplankton. The Zooplankton was recorded during the investigation was depicted in Tables 1 and 2.

#### *Benthic fauna :*

Survey for the benthic fauna has been made and few species of macro, micro fauna and molluscans were recorded by various investigators. The macro fauna comprise the burrowing fauna of sediments and the surface living fauna. The micro fauna are flagellates and numerous ciliates. The Molluscans are mainly Gastropods and Bivalves and they were the dominant forms recorded in this review investigation. Other benthic animals include insects and amphibians. The recorded benthos are *Pila* sp., *Melania* sp., *Vivipara* sp., *Parreysia favidens*, *Corbicula regularis*, *Lamelliden* sp., *Macrobrachium* sp., *Paratelphusa* sp., *Bellanya dissimilis*, *Polydomous tensenaurious*, *Tellina cuspis*, *Perna viridis*, *Anadara rhombea* and *Pheritima Oligoehaetes*, *Bufo* sp. 00.0. and *Rana* sp. among amphibians were recorded by various investigators.

#### *Fishes :*

The fishes of common occurrence at

all stations of river stretch are: *Cyprinus carpio*, *Catla Catla*, *Cirrhinus mrigala*, *Puntius sophore*, *Cirrhinus fulungee*, *Garra gotyla*, *Labeo fimbriatus*, *Labeo bata*, *L. calbasu*, *L rohita*, *Mystus cavasius*, *Sperata aor*, *Mastacembelus armatus*, *Mahasheer* sp. (*Tor tar*), *Ambassis* sp., *M.bleekeri*, *Notapterus notopterus*, *Ompak bimaculatus*, *Puntius conchoniis*, *P. sarana*, *P. carnaticus*, *Wallago attu*, *Tor khudree* and *Oreochromis mosambica*.

Among the fishes Cyprinidae was most dominant in the water bodies. This indicates good correlation with overall species richness across the sites and could be utilized by the biodiversity conservation managers for prioritization of sites of conservation and habitat restoration<sup>5,17</sup>. The fish species recorded are economically important and having high commercial significance. The fishes are categorized in to herbivores, carnivores and omnivores. In these water bodies almost all fishes recorded are useful as food fishes and *Ambassis*, *Puntius* species are used for ornamental purpose.

Thirumala and Kiran<sup>30</sup> have studied the occurrence of fish fauna in Jambadahalla lake of Chikmagalur district in Karnataka.. A total of 26 fish species belonging to 11 families were recorded by them, of which cyprinidae was dominated. The diversity of fish fauna in this lake was attributed to the introduction of exotic fish species.

The fish species recorded from Bhadra reservoir, the following are considered as economically important and cultivable fishes including *Notopterus notopterus*, *Cyprinus carpio*, *Oreochromis mossambica*, *Labeo*

*rohita*, *Cirrhinus mrigala*, *Catla catla*, *Sperata seenghala*, *Sperata oar*, *Channa striatus* and *Channa marulius*. The reservoir inhabit the ornamental fishes like *Puntius sophore*, *Puntius deucanensis* and *Puntius filamentosus*<sup>31</sup>.

#### Fishing catch and composition :

Peak fishing is mainly restricted to pre-monsoon months till the onset of monsoon. Fishing activity is generally low during monsoon season and post-monsoon months. The catch mainly consists of native species. Indian major carps like *Catla catla*, *Cirrhinus mrigala* and *Labeo rohita* are reported to occur during first flood and Juveniles of *Mystus seenghala* were recorded during post-monsoon month.

The dried fish (Figure 2) of *Salmophasia untrahi* is used in poultry in addition to human consumption. The cost of raw *Salmophasia species* is very much cheaper than the other fresh water fishes at the back water of Bhadra reservoir at N R pura, Chikmagalur district.



Figure 2. Sun dried *Salmophasia untrahi*

In addition to indigenous species, exotics like *Oreochromis mossambicus*, *Cyprinus carpio*, *Ctenopharyngodon idella*

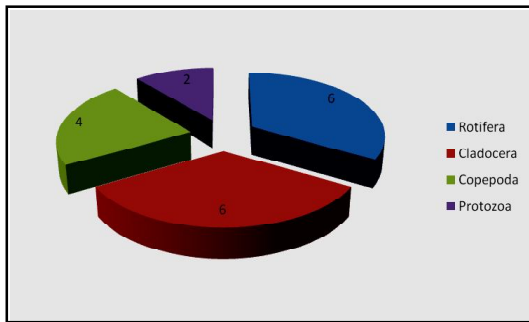


Figure 2. Group wise zooplankton species in the Lentic water bodies of Chikmagalur district

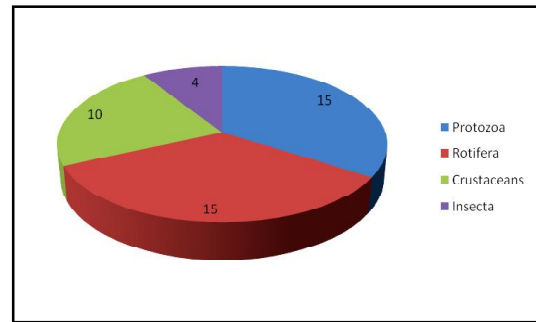


Figure 3. Group wise zooplankton species in the Lotic habitat of Chikmagalur district

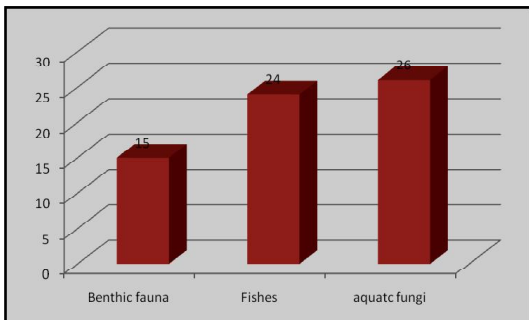


Figure 4. Number of Benthic fauna, Fishes and Aquatic fungi species in the water bodies of Chikmagalur district

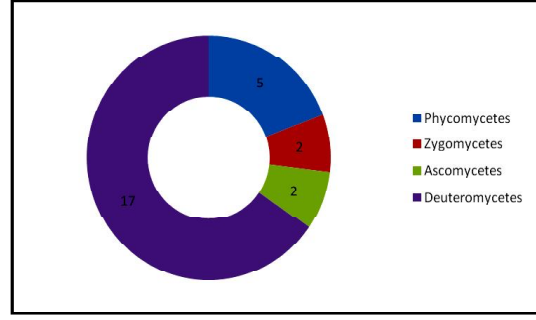


Figure 5. Number of species in each class of Aquatic fungi in the water bodies of Chikmagalur district

and *Hypophthalmichthys molitrix* have been introduced into the reservoirs of Chikmagalur district. These species are showing up in the catches of the reservoirs too, contributing to 20% of the total catch.

#### *Aquatic fungi :*

Aquatic fungi recorded in the present investigation of the river from four sampling stations have been grouped into four classes. They have been identified upto genus and species level by the help of monographs and relevant literature. They have been isolated

from driftwood, intertidal wood, submerged wood or logged wood, foam sample and sediments. The different species of aquatic fungi observed during the investigation are given in Table-3.

Aquatic fungi are rich in lotic water bodies and the conidia developed on decaying debris. A total of 30 species belongs to fifteen genera were identified by Suresha *et al.*,<sup>28</sup> in the lotic water bodies of Sringeri taluk, Chikmagalur district.

Table-1. Diversity of Zooplankton in the Lentic water bodies of Chikmagalur district

	Pond 1	Pond 2	Pond 3	Pond 4	Tank1	Tank 2	Reservoir
<b>Rotifers</b>							
<i>Brachionus falcatus</i>	-	+	-	-	+	+	+
<i>B. Caudatus</i>	+	+	+	+	+	+	+
<i>B. Calciflorus</i>	-	-	-	+	+	+	+
<i>Filinia longiseta</i>	+	-	-	+	-	-	-
<i>Keratella tropica</i>	+	-	+	-	+	+	+
<i>Lopadella ovalis</i>	-	-	-	-	+	+	+
<b>Cladocera</b>							
<i>Daphnia carinata</i>	+	+	+	+	-	-	+
<i>Diaphanosoma sarsi</i>	-	-	-	-	+	+	-
<i>D. excism</i>	+	-	-	+	+	-	+
<i>Moina daphnia</i>	+	+	+	+	-	-	-
<i>Macrothrix</i> sp.	-	+	-	-	-	-	-
<i>Bosmina</i> sp	-	-	-	-	+	+	+
<b>Copepoda</b>							
<i>Cyclops</i> sp	+	+	+	+	+	+	+
<i>Mesocyclops</i>	+	-	-	+	-	-	+
<i>Paracyclops fimbriatus</i>	+	-	-	+	-	-	-
<i>Heliodiaptous Viduus</i>	-	-	+	-	+	+	+
<b>Protozoans</b>							
<i>Paramecium</i> sp	+	-	-	+	-	-	-
<i>Vorticella</i> sp	+	+	+	+	-	-	-

Table-2. Distribution pattern of Zooplankton at different stations of lotic habitat of Chikmagalur district

Genus/ Species	Site 1	Site-2	Site-3	Site-4
<b>Protozoa</b>				
<i>Amoeba</i> sp.	+	-	+	-
<i>Ceratius</i> sp.	-	-	+	-
<i>Diffugia cotonoa</i>	+	-	-	+
<i>Spongilla lacustris</i>	+	+	-	+
<i>Sphaerophyra</i> sp	-	-	-	+
<i>Clathurina elegans</i>	+	+	+	-
<i>Trachelomonas armata</i>	-	+	-	+
<i>Parahema</i> sp	-	+	-	+
<i>Paramesium</i> sp	+	-	+	-

<i>Helophyra</i> sp	-	-	+	+
<i>Vorticella</i> sp	+	+	-	+
<i>Aspidisca</i> sp	-	+	-	+
<i>Phastolaimus</i>	+	+	-	-
<i>Arcella</i> sp	-	-	+	+
<i>Cladopoda</i> sp	+	+	+	-
<b>Rotifers</b>				
<i>Lapadella</i> sp	-	-	+	-
<i>Brachionus</i> sp	-	-	+	+
<i>B. angularis</i>	+	+	+	-
<i>B. caudatus</i>	-	-	+	+
<i>B. bidentata</i>	-	-	-	+
<i>B. forficula</i>	-	-	+	+
<i>Lecana luna</i>	+	+	-	+
<i>Platytias platulus</i>	-	-	+	+
<i>Keratella tropica</i>	+	-	-	+
<i>Kellacotina</i> sp.	-	+	+	-
<i>Monostyla</i> sp.	-	-	-	-
<i>Notholca filinia</i>	+	-	+	-
<i>Ceriodophnia</i> sp	-	+	+	+
<i>Rattulus</i> sp.	-	-	-	+
<i>Filinaia major</i>	+	-	+	-
<b>Crustaceans</b>				
<i>Bosmina longirostris</i>	+	-	-	+
<i>Polyphemus</i> sp.	+	+	-	+
<i>Cyclops</i> sp.	+	-	+	+
<i>Metanauplius</i> sp.	-	-	+	-
<i>Herpacticoid</i> sp.	-	+	+	+
<i>Diatomus</i> sp.	+	+	-	+
<i>Daphnia</i> sp.	-	+	+	-
<i>Nauplius larvae</i>	+	+	-	+
<i>Diaphansoma</i> sp.	+	-	+	+
<i>Simocephalus</i> sp	-	+	-	+
<b>Insecta</b>				
<i>Phlebotomus papatasi</i>	+	-	-	+
<i>Gerris</i> sp.	-	-	+	-
<i>Notonecta</i> sp.	-	+	+	-
<i>Chironomus larvae</i>	-	+	+	-

- = Absent + = Present



Table-3. Distribution pattern of Aquatic fungi at lotic habitat of Chikmagalur district

Genus/Species	Site 1	Site-2	Site-3	Site-4
<b>Phycomycetes</b>				
<i>Achyla</i> sp.	+	+	-	+
<i>Allmyces</i> sp.	+	-	-	+
<i>Saprolegina parasitica</i>	+	-	+	+
<i>Rhizidium</i> sp.	+	+	+	-
<i>Pithiopsis</i> sp.	-	-	+	+
<b>Ascintcetes</b>				
<i>Penicillium nigricans</i>	+	+	-	+
<i>Penicillum</i> sp.	+	-	+	-
<b>Zygomycetes</b>				
<i>Rhizopus</i> sp.	+	+	-	+
<i>Mucor</i> sp.	+	-	+	-
<b>Dueteromycetes</b>				
<i>Alternaria accuminata</i>	+	-	+	+
<i>A. longipes</i>	-	-	+	+
<i>Aspergillus candidus</i>	+	+	+	-
<i>A. niger</i>	-	+	+	+
<i>A. oxyzae</i>	+	+	+	+
<i>Curvularia brashyspora</i>	+	-	+	+
<i>C. geniculata</i>	-	+	+	-
<i>C. robusta</i>	+	+	-	+
<i>Cladosporium oxysporum</i>	-	+	+	+
<i>Cladosporium</i> sp.	+	+	+	-
<i>Fusarium</i> sp.	+	-	+	+
<i>Stachybortrys</i> sp.	-	+	+	-
<i>Fusarium spisphaeria</i>	-	+	+	+
<i>Aspergillus regulosus</i>	+	+	+	-
<i>A. flavus</i>	+	+	+	+
<i>Trichoderma viridae</i>	+	+	-	+
<i>Tetracladium</i> sp.	-	-	+	+

- = Absent

+= Present

Suresha *et al.*,<sup>27</sup> carried out the diversity of aquatic hyphomycetes on leaf bits in Kalathgiri falls of Chikmagalur District in Karnataka. They recorded 18 species of aquatic hyphomycetes belonging to 13 genera.

The present review study to a great extent centers around biotic species abundance and assorted variety of lentic and lotic habitats of Chikmagalur district. It is clear that convergence of biotic diversity is a significant issue confronting the area and it is in direct clash with the quick advancement exercises occurring in the watersheds, including those identified with aquaculture. There is a need to formulate manageable procedures to spare network of this lentic and river framework overall. Being significant water bodies of Western Ghats, supported assortment of biotic fauna. There could be uncertainties with all scientific endeavours to monitor abundance and productivity of biotic stocks and the underlying causes. Aquatic resources at the rivers of Chikmagalur district were being over exploited as observed by the researchers.

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